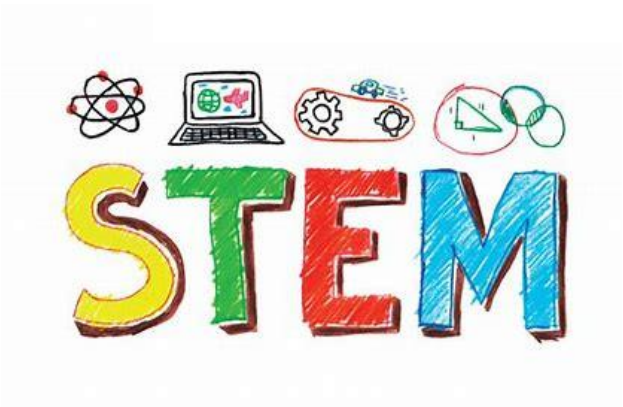
SUGGESTIONS FOR STEM LEARNING ACTIVITIES (SECOND LEVEL) LINKED TO THE SUSTAINABLE DEVELOPMENT GOALS



Aberdeenshire Council

RAiSE
Raising Aspirations in Science Education

Created by Kim Aplin, RAiSE PSDO, Aberdeenshire

'Learning for Sustainability (LfS) is an approach to life and learning which enables learners, educators, schools and their wider communities to build a socially-just, sustainable and equitable society. An effective whole school and community approach to LfS weaves together global citizenship, sustainable development education and outdoor learning to create coherent, rewarding and transformative learning experiences'. Quote from: Education Scotland Learning for Sustainability | Programmes | Learning in Scotland | Education Scotland

A refreshed Learning for Sustainability Action Plan was launched in June 2023 (Target 2030: A Movement for People, Planet and Prosperity) which puts sustainability at the heart of the Scottish education system.

The new plan aims to ensure that:

- All learners receive their Learning for Sustainability entitlement
- All 3-18 learning settings and schools become sustainable by 2030

Learning for Sustainability involves many different aspects which are summarised in this sketchnote produced by Education Scotland:

Learning for Sustainability (education.gov.scot)

The Sustainable Development Goals were created by the United Nations and are promoted as the Global Goals for Sustainable Development. The United Nations Sustainable Development Goals are central to Scotland's national vision and are at the heart of the Scottish Government's National Performance Framework.

Do you know all 17 SDGs? (youtube.com)

SUSTAINABLE DEVELOPMENT GOALS 📄🌍 What are the SDGs? 👧🧒 Compilation (youtube.com)

The 17 UN SGDs. Source un.org

This resource looks at suggestions for using STEM (science, technology, engineering and maths) learning activities for Second Level to teach/make links to the Sustainable Development Goals.

Some of these activities involve Engineering. What is an engineer? What do they do? (*An engineer is someone who uses science and maths to develop solutions to problems. Engineers do not just build machines. They also design systems to make things function better).*

https://www.youtube.com/watch?v=owHF9iLyxic&t=2s

Engineers use something called the ‘Engineering Design Process.’ Find out about the Engineering Design Process by watching this video:

[Engineering Design Process - YouTube]

By using this approach with the children, the learning activity becomes a skill focussed, STEM (engineering) learning activity.

- **ASK:** Students identify the problem, requirements that must be met, and constraints that must be considered.
- **IMAGINE:** Students think about solutions and research ideas. They also identify what others have done.
- **PLAN:** Students choose two to three of the best ideas from their list and sketch possible designs, ultimately choosing a single design to prototype.
- **CREATE:** Students build a working model, or prototype, which aligns with design requirements and that is within design constraints.
- **TEST:** Students evaluate the solution through testing; they collect and analyse data; they summarise strengths and weaknesses of their design that were revealed during testing.

- **IMPROVE:** Based on the results of their tests, students make improvements on their design. They also identify changes they will make and justify their revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Note: Different sources have slight variations in the steps/number of steps identified in the design cycle, but they are broadly the same/very similar.

The Royal Academy of Engineering have identified common attributes and the skills engineers have regardless of their engineering discipline; they call these the **Engineering Habits of Mind**.

There are six Engineering Habits of Mind, and these have now been broken down into more specific skills which are transferable across all curricular areas:

Systems Thinking – Smaller parts coming together to make a whole.

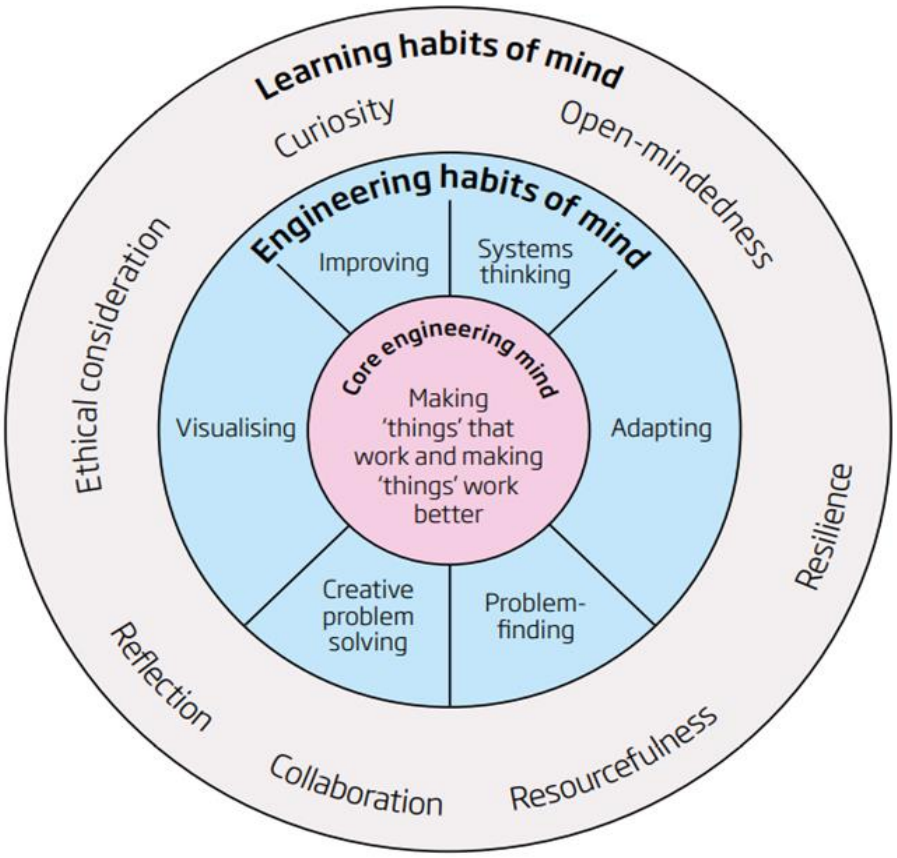
Problem Finding – Finding problems, deciding how to fix them and checking existing solutions.

Visualising – Thinking about how the final product will look.

Creative Problem Solving – Working together to create solutions to problems.

Improving – Making things better.

Adapting – Applying things in a new context.



More information can be found here:

Bill Lucas Webinar: Engineering Habits of Mind:
https://www.youtube.com/watch?v=1Ty3MIDPZ3s

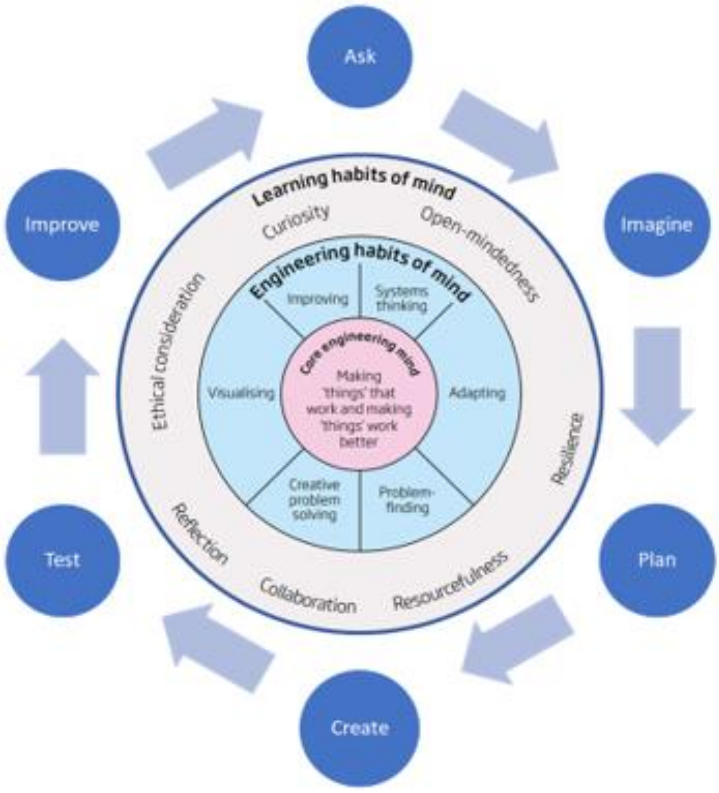
These have been broken down:

Systems thinking	Problem-finding	Visualising
Using ideas from one subject in another subject	Asking lots of questions to make sure I understand	Thinking out loud when I am being imaginative
Working out the possible consequences of something, before they happen	Finding out why something doesn't work	Making a plan before I start work
Putting things together to make something new	Checking and checking again until I'm happy	Practising something in my head before doing it for real
Spotting similarities and difference between things	Finding mistakes in mine and other people's work	Making models to show my ideas
Spotting patterns and working out what comes next	Thinking about the world around me, and how it could be better	Explaining my ideas to other people so that they understand

Creative problem solving	Improving	Adapting
Coming up with lots of good and new ideas	Working hard and practising to get better, even when it's tricky	Explaining how well I am doing to my teacher or friends
Making really detailed mind-maps	Working out what I need to do to improve	Evaluating how good something is
Thinking before doing something	Making what I've done better	Sticking up for what I think when talking with other people
Working succesfully in a group	Experimenting with things, just to see what happens	Deciding how something could be done differently
Taking on board other people's ideas and using them	Sticking at doing something until it's the best it can be	Behaving appropriately in different settings

Royal Academy of Engineering | Education Resources Hub

We can help the children to develop these skills, and to 'think like an engineer' by using these alongside the Engineering Design Process:



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Sharing ideas and communicating findings is a really important part of STEM learning. After completing an engineering challenge, using questions for reflection is a great way to start the children talking about their experience and to encourage discussion of results and critical thinking.

For example:

What were some of the challenges you experienced along the way? How did you overcome them?

What worked well and what didn't work well?

What part of your model or prototype do you really like? Why?

What part of your model or prototype needs improvement? Why?

What other materials would you like to use if you were going to do this challenge again?

What would you do differently next time?

Although in this resource there are suggested STEM activities for each individual Sustainable Development Goal, the SDGs are all interlinked which means the activities suggested here can be used for STEM related learning related to more than one goal.

No poverty SDG 1 Sustainable Development Goals for Kids (youtube.com)

Poverty is when people are unable to meet their basic needs due to lack of resources. Poverty is not just about not having money, it is also about not having access to things that may seem basic such as food, clean water, a home or health care. The causes of poverty are many and include: the lack of opportunity for education, illness which can prevent people from going to school or work, climate change which makes it harder to grow crops so farmers can't feed their families or earn enough from selling their crops, natural disasters such as floods and droughts which can destroy homes and cities and cause infectious diseases to spread, civil war, hunger, lack of employment opportunities etc.

Activity 1: Paper Bag Game (taken from Teaching Resources | Concern Worldwide *see pages 8 – 11)*

In the city of Dhaka, Bangladesh some people earn money by making paper bags out of recycled waste paper – such as old newspapers – and then sell them to shopkeepers. These are made mostly by women and children from poor families and are sold in batches of 20. On average, a child makes 200 bags in a day. For this, the child will earn about 15 ৳ - which is equivalent to £0.11 or 11 pence.

The object of the Paper Bag Game is to show how hard some people work but yet earn so little. Using real cost of-living prices and wages, players of the game can get an idea of how they would manage if they had to survive making and selling paper bags.

Links to Es and Os and relevant benchmarks:

I can manage money, compare costs from different retailers, and determine what I can afford to buy. **MNU 2-09a**

- Carries out money calculations involving the four operations.
- Compares costs and determines affordability within a given budget.

I can use the terms profit and loss in buying and selling activities and can make simple calculations for this. **MNU 2-09c**

- Calculates profit and loss accurately, for example, when working with a budget for an enterprise activity.

Links to other SDGs :

Decent work and economic growth

Activity 2: Design and build an earthquake resistant structure

Earthquakes can cause walls to crack, foundations to move and sometimes entire buildings to crumple and collapse. Therefore, when engineers design buildings for areas that have earthquakes, have to include things that can survive earthquake forces. These might have cross bracing or be buildings that have large bases and are tapered.

Earthquake-proof buildings need to be able to bend and sway with the motion of earthquakes. Engineers use the Engineering Design Process to come up with an idea, test it, and then improve the structure based on its performance during testing.

Background:

Earthquakes are natural hazards that cause very sudden and forceful shaking of the Earth's crust. Earthquakes happen frequently where the edges of the tectonic plates meet. When these plates hit or slide past each other, they release built up stress. The surface where the tectonic plates slip is called a fault. The point where an earthquake occurs is called the **focus** of the earthquake, which can be close to or far below the Earth's surface.

The place on the Earth's surface that is directly above the **focus** is called the **epicenter** of the earthquake and this is where most of the damage happens.

Large earthquakes can cause loss of life and millions of pounds worth of damage, and can destroy homes and cities and the infrastructure (e.g. road and transport systems, bridges, drainage systems, shops, water and energy supplies, communication systems etc) of a community and can also result in infectious diseases spreading due to contaminated water supply and poor sanitation.

Your team of Engineers has been asked by *ScotAid,* an organisation that organises projects for countries in need, to design a structure that can withstand the vibrations of an earthquake.

Using the Engineering Design Process:

- **ASK:** Design a structure that can withstand the vibrations of an earthquake.

  Criteria:
  The building must be at least 12 cm /2 storeys high
  The building must contain at least 1 triangle
  The building must contain at least 1 square
  Constraint: You can only use the materials provided

- **IMAGINE:** Find out about what happens in an earthquake, for example:
- https://www.youtube.com/watch?v=AArne-wh_Uc&t=1s
- https://www.youtube.com/watch?v=iGtRko8y4Fo&t=2s)

How do you think engineers design earthquake-proof buildings? Research ideas about different designs and the ways engineers make buildings 'earthquake proof'. Start to think about what your design might look like and make a list of ideas and sketch some of your ideas.

Cubes and triangles are like building blocks that may be stacked in different ways to make towers. *Buildings can have a small or large base.* Have students draw and label the shapes in their designs (cube, triangle, etc.).

- **PLAN:** Choose two of your best ideas from your list and plan possible designs in detail, labelling the shapes in the design (cube, triangle, etc.) Now choose one design to prototype.

- **CREATE:** Build your prototype of your best design

- **TEST:** Evaluate the design by testing it by simulating an earthquake by placing the structure on the top of the set jelly and shaking the container. Pay attention to what needs to be changed to the model to make it work better but also look for where the model is working well.

- **IMPROVE:** The last step of the Engineering Design Process is to **improve** (iterate) the design. These improvements are based on the results of the tests. Then test the model again and improve.

Building materials:

30 toothpicks and 30 marshmallows

8 square containers of set jelly (about 20cm x 20 cm) or one large container of jelly for the class to share.

Earthquake in the Classroom (youtube.com)

Alternative building materials to use – either all of them or a selection of:

Spaghetti, straws, lollipop sticks, playdough, gum drops

Ideas to increase the level of challenge :

Add an additional challenge of height- how tall can you create your structure to withstand the earthquake?

Limit the number of materials that will be used

Add a cost to purchasing the items and set a budget (e.g. toothpicks £0.50 each, marshmallow £.0.50 each, playdough £1.00 per 'portion', lollipop sticks £0.75 etc. Budget £25.00 (maximum) to spend).

Links to Es and Os and relevant benchmarks:

I can describe the physical processes of a natural disaster and discuss its impact on people and the landscape. **SOC 2-07b**

- Describes the causes of a natural disaster such as a volcano, earthquake or extreme weather event.
- Describes the impact of the natural disaster giving at least three examples for people and one for the landscape. Impact can be positive or negative.

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

I can extend and enhance my design skills to solve problems and can construct models **TCH 2-09a**

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

- Builds/simulates solutions to engineering problems.

OR: **Beat the Flood Challenge:**

https://practicalaction.org/schools/beat-the-flood/ this challenge involves designing and building a model flood-proof home which is then tested in 'flood' conditions.

During this challenge, the children will develop an increased awareness and understanding of how STEM (engineering) plays an important role in helping to tackle global poverty.

This challenge could be further extended to involve Maths by costing out the buildings and also thinking about the price of rebuilding communities affected by flooding and discussing the reasons why their houses were made of possibly inferior materials in the first place.

Links to other SDGs:

Sustainable cities and communities

Zero Hunger SDG 2 Sustainable Development Goals for Kids (youtube.com)

815 million people suffer from hunger, or 11% of the world's population. The vast majority of hungry people live in developing countries.

Hunger is a physical sensation, indicating the need to eat, but hunger also refers to the lack of basic food for adequate nutrition.

A third of the world's food is wasted, yet over 800 million people are undernourished.

Two of the biggest causes of hunger are:

- Extreme climate events such as flooding, storms, droughts and extreme heat/cold temperatures can cause crop losses, very lower yields (how much is produced) and loss of livestock. If less food is produced this puts pressure on markets and the price of food of food goes up which impacts all people, but especially the poor. It also means that income is lost by those whose crops are effected.
- Conflict - almost all conflicts result in hunger. Conflict destroys agricultural land, increases the price of food and forces people to leave their homes therefore their way of earning an income or their way of producing food behind. Food is also sometimes used as a weapon of war through imports being restricted, taking land off people and limiting humanitarian aid to certain areas.

Making sure people have food is always a challenge, and more people in the world means more people to feed. No single solution can solve the challenge of feeding the world's growing population.

Hydroponics means growing plants without soil. The plant foods are simply put into water and it makes a solution for the plants to live in. Vegetables, flowers and herbs can all be grown in water.

Growing Plants Without Soil! | Squeaks Grows a Garden! | SciShow Kids (youtube.com)

What is Hydroponics (youtube.com)

Hydroponics allows a farmer to grow plants very efficiently and might be one way to help feed the world's population as our population continues to grow.

Hydroponics can also help to prevent soil erosion and areas of desert can also be transformed into areas of productive land. Can the children imagine where it would be

useful to be able to grow plants without soil? Especially edible plants? *(Cold places with no soil - Iceland, Antarctica, hot places with no soil - Sahara, Mars)*

Hydroponics has been used successfully in an experiment in Antarctica:

Scientists in Antarctica have harvested the first crop of vegetables grown without soil or light. (youtube.com)

http://www.antarctica.gov.au/living-and-working/station-life-and-activities/food/hydroponics

And by NASA:

Hydroponics in Space | How astronauts use hydroponics to grow food in space (youtube.com)

https://www.youtube.com/watch?v=weI0WUI9lkk

There are six basic types of hydroponic systems: wick system, water culture system, ebb-and-flow system, drip system, nutrient-film technique, and the aeroponics system. Each system has its advantages and disadvantages. Hydroponics is maybe something that the children could research and find out more.

Activity 1:

Ask the children what do plants need to grow? They will probably say light, air and soil. Do you think plants need soil to grow? Why? What does the soil do?

By growing in a hydroponic environment, the soil is removed and children will learn how nutrients, water, and light help a plant to grow.

You will need:

Empty 2-litre plastic bottle

Growing media *(e.g. coconut coir. Soil and coconut coir are both growing mediums, but soil contains the nutrients a plant needs to grow, and coconut coir does not).*

Water – bottled or filtered is best. If using tap water and it is chlorinated, it needs to sit overnight before using to allow the chlorine to evaporate

Wicks or a wicking material – felt or old cotton towels cut into strips about 2cm x 20cm

Aluminium foil to cover the bottom of the bottle to prevent algae from growing

Nutrients – a general hydroponics fertilizer e.g. https://amzn.eu/d/gyBLQja or https://amzn.eu/d/a1aCiaE

Disposable gloves and a container with a lid to mix the water and the nutrients

Permanent marker or sharpie

Scissors

Seeds or a small plant e.g. lettuce, spinach, basil

Optional: pH control kit

1. Add water to the coconut coir to expand and loosen it.

2. Start by creating a hydroponics container from the empty, clean 2-litre plastic bottle. Use the permanent marker to draw a line around the bottle just below where the cylinder starts to curve in toward the cap. Cut the bottle along the line with scissors **– adult supervision required or to be done by an adult**. Turn the top upside down and rest it in the larger, bottom part of the bottle. The bottom part is the reservoir and plant will grow in the upside down top part.

3. Make a wick by knotting two of the cotton or felt strips together at one end; the wick will take the nutrient rich water from the reservoir to the roots of the plant.

4. Push the loose ends through the bottle top so they hang down into the reservoir; the knot is to stop the wick from falling all the way through.

5. Place the top with the wick back into the reservoir and fill it with the coconut coir. Make sure the wick is about 2/3s of the way into the coconut coir so that the water containing the nutrients stored in the reservoir can reach the plant's roots.

6. Place 3 seeds into the coconut coir just above the knot in the wick.

7. ***Handle chemicals with care*** - **adults only**: wearing disposable gloves, prepare the water by mixing the water and nutrients together according to the mixing chart on the bottle.

8. Pour in the water containing the nutrients over the coconut coir and let it seep in until the reservoir is about 1/2 to 2/3s full.

9. Cover the reservoir with aluminium foil to prevent algae growing.

10. Once the seed is sprouted, place the container near a window. For the first couple of days, check every day to ensure the area around the seed or tiny plant is moist. Add a little water if needed. As the plant grows, its roots will grow deeper and get better access to the water and nutrients sucked up by the wick.

11. Once the plant is established, check the reservoir weekly and add some more nutrient rich water when necessary. Check the directions that come with the nutrients; you will probably need to add more nutrients for the same amount of water once the plant is well-established.

This is a video of how to set up your hydroponics container:

Hydroponics in a 2-Liter Soda Bottle – Science Project (youtube.com)

What happened? Did the plants grow?

Do plants in nutrient rich soil grow faster or better than hydroponic plants? Can the children design a fair test investigation to find out? (*A plant with its roots in soil uses a lot*

of energy getting its nutrition from the soil. In hydroponics, the nutrients are directly available at the plant's roots. So, without any work, the plant gets its water and nutrition so it can spend more energy growing leaves, fruits, and flowers so it generally grows more in a shorter amount of time).

Another fair test investigation could be:

What happens when you don't add the nutrients to the water? i.e. What if the plants only have water and not nutrient- enriched water?

Links to Es and Os and relevant benchmarks:

I have collaborated in the design of an investigation into the effects of fertilisers on the growth of plants. I can express an informed view of the risks and benefits of their use.
SCN 2-03a

- Collaborates with others to present a reasoned argument, based on evidence, of the risks and benefits of using fertilisers, demonstrating understanding of the underlying scientific concepts.

Through research and discussion, I have an appreciation of the contribution that individuals are making to scientific discovery and invention and the impact this has made on society. **SCN 2-20a**

- Describes the impact of scientific discovery, creativity and invention on society past and present, for example, in design, medicine and agriculture.

Activity 2: Design a floating hydroponics system

(*In this system, plants float on rafts above a reservoir of nutrient solution. Styrofoam rafts work well in the classroom. The tips of the roots reach the liquid and the holes cut in the raft for the plants allow some air exchange).*

(76) Pinterest

Hydroponics 5 gallon bucket and pool Noodle easy cheap set up (youtube.com)

Using the Engineering Design Process, design a floating hydroponics system to grow basil

- **ASK:** Design a floating hydroponics system to grow basil
  Criteria: Your system must have space for 3 separate plants
  Constraint: you can only use the materials provided

- **IMAGINE:** Think about solutions and research different hydroponic systems and what others have done. Draw and explain possible solutions. Wild ideas are ok! They may lead to the best solution!

- **PLAN:** Choose two to three of the best ideas and sketch possible designs, ultimately choosing a single design to prototype.

- **CREATE:** Build a prototype, which aligns with design requirements and that is within the design constraints.

- **TEST:** Evaluate the solution through testing and collect and analyse data; summarise strengths and weaknesses of the design that were revealed during testing. This will take time as the seeds will need to germinate and grow!

- **IMPROVE:** Based on the results of the tests, make improvements on the design. Identify changes to make and justify the revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Materials: basic recyclables – egg cartons, plastic bottles, plastic containers, Styrofoam, polystyrene, old foam 'pool noodles', cotton wool, string etc.

Fabric – e.g. towelling or felt

Basil seeds

Water

Nutrients - a general hydroponics fertilizer e.g. https://amzn.eu/d/gyBLQja or https://amzn.eu/d/a1aCiaE

Handle chemicals with care - **adults only** *

**For advice about safety, please refer to the book:*

[Be Safe - SchoolScience.co.uk]

or contact SSERC*:* [enquiries@sserc.scot]

Links to Es and Os and relevant benchmarks:

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

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- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
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I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

- Builds/simulates solutions to engineering problems.

OR The Road to Zero Hunger – Action Against Stunting Day

The Road to Zero Hunger challenge introduces children to the Action Against Stunting project. The activities enable pupils to explore areas of the AAS project including the impact of diet and access to local markets to buy fresh produce.

The children's learning culminates with a challenge to apply their STEM (engineering) skills to solve a problem experienced by many farmers: how do you package, then

transport fresh and nutritious produce from the farm to local markets using affordable transport?

Activity 3:

Link your school with a community garden in your area so that the school can contribute to their work to helping maintain and grow fruit and vegetables for people in the community.

Links to other SDGs:

Good health and wellbeing

Sustainable cities and communities

https://www.youtube.com/watch?v=ARmBCl4nid0

Good health and well-being extends beyond simply eating well. Good health and wellbeing is vital for all people, no matter where they live. If we are unwell we can get medical help and have access to health services. In many areas of the world, particularly in developing countries, this is not always the case.

Goal 3 of the Sustainable Development Goals aims to ensure that all people, at every stage of life, can live healthy lives; being ill can stop someone from going to school, or to work or enjoying life.

Activity 1

Background information:

Vaccines are substances that prevent the spread of disease. Giving people vaccines as part of an immunisation programme can save millions of lives. For example, smallpox killed some 2 million people in 1967. By 1979 the disease had disappeared. This change was a result of a worldwide program of vaccination.

Many diseases are caused by bacteria or viruses. When people are vaccinated against a disease, they are purposely given the bacteria or virus that causes the disease. They can receive the vaccine in an injection, by mouth, or by a nose spray.

The bacteria or virus used in a vaccine is dead or weakened or made from organisms which are similar but not exactly the same as the microbes that make us ill. The vaccine causes little if any sickness to the person who receives it. When the vaccine enters the body, the immune system attacks it as if the harmful microbes were attacking the body. The white blood cells create lots of antibodies called antigens. Because the vaccine has an extremely weakened version of the microbes that cause illness, the white blood cells successfully destroy all these cells and they will not make you ill. The immune system remembers how to destroy those microbes so the next time the same microbes enter the body, the immune system is ready to fight them before they have a chance to make someone ill.

Immunisation (the process of both getting the vaccine and becoming immune to the disease following vaccination) is one of the most cost-effective ways to protect the health of children and saves millions of lives every year. Today, there are vaccines available that prevent more than twenty life-threatening diseases, which means people of all ages are living longer, healthier lives. Yet, too many people around the world – including nearly 20 million babies and young children each year – do not have access to vaccines.

Vaccines are really important to ensure that all people, at every stage of life, can live healthy lives. Vaccinations are important: the measle vaccine for instance resulted in an

80% drop in death from measles between 2000-2017. Today, vaccines save 2-3 million lives every year and millions of children are alive and healthy thanks to the power of vaccines.

The children could:

- research how vaccines work and why they are so important
- find out how the immune system works
- research some of the scientists involved in microbiology and medicine for example:
    - ❖ Antoine Van Leeuwenhoek
    - ❖ Louis Pasteur
    - ❖ Robert Koch
    - ❖ Edward Jenner
    - ❖ John Snow
    - ❖ Alexander Fleming

They could present their research as e.g. a film, a play, a digital book, a PowerPoint or Sway presentation etc.

Links to Es and Os and relevant benchmarks:

Through research and discussion, I have an appreciation of the contribution that individuals are making to scientific discovery and invention and the impact this has made on society **SCN 2-20a**.

- Researches historic and contemporary scientists (ensuring gender balance) and their scientific discoveries and reports collaboratively to others using a range of methods.
- Describes the impact of scientific discovery, creativity and invention on society past and present, for example, in design, medicine and agriculture.
- Demonstrates understanding of how science impacts on every aspect of our lives.
- Relates the development of scientific skills in the classroom to an increasingly wide variety of science, technology, engineering and mathematics (STEM) careers.

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science **SCN 2-20b**

- Explores items of current scientific interest within the school, local community, nationally or in the global media and collates, organises and summarises findings, with assistance

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

Activity 2: Which insulation material is best to protect vaccines from high temperatures?

Lots of countries experience high temperatures at certain times of the year. How could the vaccine be protected from the heat while it is being transported?

Background information:

Temperature regulation is important in many aspects of engineering: for example, packaging engineers design containers and systems so that items can be transported at specific temperatures, mechanical engineers make sure that working engines do not overheat, and civil engineers use the most suitable insulating materials for the climates where their structures are built. Temperature regulation applies an understanding of the principles of heat transfer, which is relevant in almost all engineering disciplines.

Insulating Ice - NUSTEM

Heat energy is lost or transferred in three ways – by conduction (objects touching each other), convection (movement of a group of molecules, such as a warm current of air rising), or radiation (electromagnetic waves). Ice melts when you take it out of the freezer because the air in the room is warmer than the melting point of ice. Heat from the air is transferred to the molecules in the ice causing them to gain energy and this causes the ice to change to liquid (water).

If we want to stop ice from melting (or vaccines from getting warm) , we need to insulate so that warm gases (warm air) or warm solids (the table top, etc.) or warm liquids aren't touching them.

The children design and carry out a fair test investigation to find the best material to slow down ice melting/that will keep the vaccine cool for longest. You will need to include a control: a **control** is a sample that remains the same throughout the investigation i.e. an ice cube with no insulation.

Note: melting will occur during the investigation but more slowly.

Materials: Plastic containers with lids, small plastic containers or cups, a variety of possible insulation materials e.g. paper, bubble wrap, fabrics, cling film, pom-pom balls, wood shavings, craft stuffing/filler, cotton wool, elastic bands, newspaper, Styrofoam, foil etc. Sellotape, ice cubes.

Other things to try:

What happens when you insulate the inside of a container rather than the outside?

What happens if you use the same amount of ice but in smaller cubes?

OR: Use the Engineering Design Process and challenge the children to design and build a 'cooler/container' that will keep ice frozen for e.g. 4 hours

e.g. How to Build a Container Where Ice Will Not Melt for 4 Hours | Sciencing

Links to Es and Os and relevant benchmarks:

By contributing to investigations into familiar changes in substances to produce other substances, I can describe how their characteristics have changed. **SCN 2-15a**

- Uses scientific vocabulary such as ‘melting’, ‘freezing’, ‘evaporating’ and ‘condensing’ to describe changes of state.

Activity 3: How many bacteria can fit on a full stop?

https://www.sserc.org.uk/wp-content/uploads/2020/10/SSERC-PB-90-Microbes-for-minors.pdf

Bacteria on a full stop (youtube.com)

Microbes are so tiny that it is difficult for children to imagine the huge numbers of microbes that surround us every day. This activity designed by SSERC is a way of modelling numbers and scale to help them understand some of these concepts.

You will need:

54 cm diameter hoop – this represents a full stop

Standard size plastic counters - this represents the bacteria

Ask the children to estimate how many ‘bacteria’ would be needed to cover the ‘full stop’. Make a note of their estimates and then allow them to carry out the activity. *(SSERC recommend packaging the counters into bags of 20 before the activity – this makes it much easier to work out how many counters have been used to cover the area of the hoop.)*

NB: It is important to emphasize to the children that less than 5% of microbes cause harm – the rest are either benign, useful or vital to life.

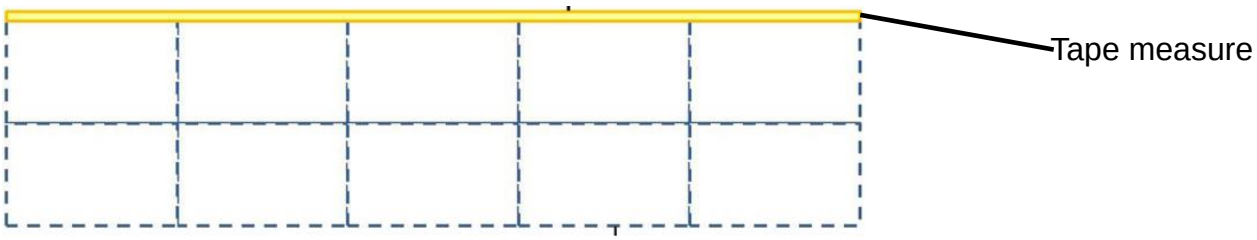
Activity 4: Coughs and sneezes spread diseases

Some infections affect the lungs (chest). Coughs and sneezes contain droplets of fluid which also contain germs that can infect other people. How far can the germs travel in a sneeze?

Note: Diseases are often spread by more than one method and those spread by coughs and sneezes are usually also spread by contact.

The activity takes place in the ‘Sneeze Zone’. Here the children will measure the distance of droplets carried by a ‘sneeze’ simulated by using water in a spray bottle.

The Sneeze Zone can be created either on the floor or on a set of tables pushed together. To create the Sneeze Zone, stick together 10 pieces of A1 flipchart paper as shown:



Place a tape measure (approximately 4m long) along one side of the Sneeze Zone and secure with tape. Add water to the spray bottle: you may like to add food colouring to make it easier to see the droplets.

1: Sneeze only

Everyone should draw a round face or a stick person on paper to represent a person and place the “people” on the Sneeze Zone so that there is a person on every square of the sneeze zone.

One pupil now uses the “nose” (water sprayer) to sneeze twice (spray the water). The group should then measure how far the water droplets travelled using the tape measure on the side of the Sneeze Zone mat and record the information.

Count how many people on the mat were affected by the sneeze by checking the pictures of the people for any water marks. If there are any marks, the children should draw a red circle around them and record the number. Wipe away the water droplets from the mat.

Stage 2: Sneeze with hand

Repeat the steps above but this time the children put a gloved hand in front of the “nose”. Measure the distance the water travelled and count how many people were affected by the sneeze this time. Draw a blue circle around the water marks (if any). Record the data and wipe away the water droplets.

Question*: Why were less people affected this time?*

Placing a hand over your mouth when you sneeze creates a barrier that stops the microbes from spreading. However, it is important to remember that the microbes are now on your hands if you do this so it is important to wash your hands to prevent spreading them any further.

Stage 3: Sneeze with tissue

Repeat the process but this time the children put tissues in front of the “nose” and “sneeze” twice. Measure the distance travelled by the water and count how many people were affected. Draw a black circle around the water marks (if any) and record the data. Wipe away the water droplets.

Question: *Were any people affected this time? Why not?*

What should they do with the tissue now? The tissue acted as barrier and instead of covering your hands, the microbes are now contained within the tissue. Some bacteria and viruses can survive on surfaces for over 24 hours so it is really important that any dirty tissues are put in the bin so the microbes cannot spread any further

Ask the children to think about and discuss the following questions after their experiment:

Was your sneeze experiment perfect? What worked well? Even better if..? What could you improve next time?

The results of the investigation then could be graphed and discussed.

Links to Es and Os and relevant benchmarks:

I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems. **MNU 2-11b**

- Chooses the most appropriate measuring device for a given task and carries out the required calculation, recording results in the correct unit

I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way. **MNU 2-20b**

- Collects, organises and displays data accurately in a variety of ways including through the use of digital technologies, for example, creating surveys, tables, bar graphs, line graphs, frequency tables, simple pie charts and spreadsheets.
- Analyses, interprets and draws conclusions from a variety of data.

I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs, making effective use of technology. **MTH 2-21a / MTH 3-21a**

- Displays data appropriately making effective use of technology and chooses a suitable scale when creating graphs

Activity 5: Step counter (Pedometer) using the micro:bit

Being active every day is important for a healthy body and mind! Turn the micro:bit into a step counter:

Step counter | micro:bit (microbit.org)

We all have a natural walking pace or rhythm that feels comfortable. The number of steps you take per minute is called *cadence.*

Can the children work out their natural walking speed in centimetres per minute?

What to do:

Walk at normal pace for one minute and record the number of steps taken using the pedometer.

Repeat three times and average the result.

Graph your class results and compare with your classmates. *Are you a slow or fast walker compared to others in the class?*

Can you use your data to calculate how far you would walk in 5 minutes, 15 minutes or 1 hour?

Links to Es and Os and relevant benchmarks:

I can create, develop and evaluate computing solutions in response to a design challenge **TCH 2-15a**

- Creates programs in a visual programming language including variables and conditional repetition.
- Identifies any mismatches between the task description and the programmed solution, and indicates how to fix them

I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use. **MNU 2-10b**

- Chooses the most appropriate timing device in practical situations and records using relevant units, including hundredths of a second.

I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way. **MNU 2-20b**

- Collects, organises and displays data accurately in a variety of ways including through the use of digital technologies, for example, creating surveys, tables, bar graphs, line graphs, frequency tables, simple pie charts and spreadsheets.
- Analyses, interprets and draws conclusions from a variety of data.

I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs, making effective use of technology. **MTH 2-21a / MTH 3-21a**

- Displays data appropriately making effective use of technology and chooses a suitable scale when creating graphs.

Links to other SDGs:

No poverty

https://www.youtube.com/watch?v=LIExX9St4oA

The fourth Sustainable Development Goal is ensure that children, adolescents and adults have access to the quality education.

Education is the process by which people gain knowledge and an awareness of themselves and others (including developing talents and skills) and is very important for leading a fulfilling and independent life.

Many people around the world do not have access to education; over 600 million children don't get a basic level of education in reading and mathematics. According to data from the United Nations, more than 260 million children in the world do not go to school, or rather, they cannot go to school. Sometimes it is because children live far away from their schools and have to travel very long distances every day to go to school. Sometimes it is due to poverty – many children have to start working when they are very young in order to help their families, so they have to leave school before they finish their studies. It is estimated that globally there are 218 million child labourers that are between 5 and 17 years of age and 152 million of these children are working in hazardous conditions.

Activity 1: Get your class involved in local or national STEM competitions/ challenges/ events.

E.g. *If you were an Engineer what would you do?* FREE STEM resources for teachers & parents - Leaders Award;

British Science Week: Homepage - British Science Week

BIEA Youth STEAM Competition 2022-2023 Competition – BIEA Competitions

First Lego League What is FIRST LEGO League? | FIRST (firstinspires.org)

STEM (Science, Technology, Engineering, and Mathematics) learning experiences encourage problem-solving, creativity, curiosity, innovation, enquiry skills, collaboration, communication and allow for real-world application. They can highlight the kinds of problems people are paid to solve every day.

STEM learning provides opportunities to experiment, make mistakes and learn from hands on experiences to reach correct outcomes, rather than relying on what the textbook says. STEM learning involves analysing, synthesizing, evaluating, and creating and can develop both knowledge and the ability to apply that knowledge in real-world scenarios.

STEM skills are transferable across the curriculum and to a wide range of situations that children may face later in life. Many current and future jobs are also related to STEM

subjects; STEM fields are known for their significant growth and rewarding job opportunities too.

Activity 2: Organise a class or school STEM challenge

A STEM Challenge is a problem which requires learners to use their skills and knowledge from Science, Technology, Engineering and Maths to design, build, test and improve a solution (see above)
Examples:

- 50+ Primary level STEM activities for any classroom
- Key Stage 1, 2, 3 and Key Stage 4 free STEM resources (theiet.org)
- Bring engineering into your primary school (stem.org.uk)
- 24 STEM Lessons You Can Quickly Deploy in the Classroom - Edu News | NASA/JPL Edu
- Practical Action STEM Teaching Resources | Global Goals (globalgoalscentre.org)

Activity 3: Learners design their own STEM challenges

The children design their own STEM challenges using the Engineering Design Process

They complete the entire Engineering Design Process from start to finish on their own by identifying a problem that is meaningful to them from their own lives e.g. design a way to keep their crayons organised or a device that prevents their cat from scratching them. Once the children have identified a problem, lead them through the Engineering Design Process to arrive at a solution. You could turn the classroom into an “Invention Museum” to showcase their work.

Activity 3: Young STEM Leader Programme (YSL)

The Young STEM Leader Programme is an opportunity for young people to inspire, lead and mentor their peers through the creation and delivery of STEM activities and events in their schools, communities and youth groups.

About | Young STEM Leader

Links to Es and Os and relevant benchmarks:

I can extend and enhance my design skills to solve problems and can construct models **TCH 2-09a**

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

- Builds/simulates solutions to engineering problems.

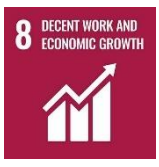
Representing my class, school and/or wider community encourages my self-worth and confidence and allows me to contribute to and participate in society. **HWB 2-12a**

NOTE: *Depending on the tasks undertaken, there will be links to other Es and Os*

Links to other SDGs:

No poverty

Gender equality



Decent work and economic growth

Reduced inqualities

Gender Equality 👧👦 SDG 5 👩 Sustainable Development Goals for Kids (youtube.com)

Gender equality is when all people, regardless of whether they are man or women, boy or girl, all have the same opportunities, rights and benefits and are treated with respect in all parts of their lives.

Only 13% of the world's land is owned by women and women are often paid less for doing a similar job to men and have less access to education. Although a lot of progress has been made, women and girls around the world still do not have access to the same opportunities as men.

Activity 1: Find out about famous women in STEM

Research famous women in STEM and find out about their careers and their achievements and the impact of their work.

For example:

- Marie Curie
- Ada Lovelace
- Rosalind Franklin
- Valentina Tereshkova
- Mary Somerville
- Katherine Johnson
- Mary Anning
- Jane Goodall
- Sarah Gilbert Prof Sarah Gilbert: The woman who designed the Oxford vaccine - BBC News

This could be linked to : International Day of Women and Girls in Science | United Nations

They could present their research as e.g. a film, a play, a digital book, a PowerPoint or Sway presentation, a poster etc.

Activity 2: Invite female scientists and engineers to speak to the class

These could be parents/carers or members of the local community or request a STEM ambassador:

STEM Ambassadors | Scotland | STEM Ambassadors in Scotland

Links to Es and Os and relevant benchmarks:

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

Through research and discussion, I have an appreciation of the contribution that individuals are making to scientific discovery and invention and the impact this has made on society **SCN 2-20a**.

- Researches historic and contemporary scientists (ensuring gender balance) and their scientific discoveries and reports collaboratively to others using a range of methods.
- Describes the impact of scientific discovery, creativity and invention on society past and present, for example, in design, medicine and agriculture.
- Demonstrates understanding of how science impacts on every aspect of our lives.
- Relates the development of scientific skills in the classroom to an increasingly wide variety of science, technology, engineering and mathematics (STEM) careers.

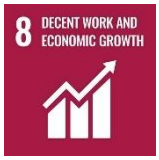
I can report and comment on current scientific news items to develop my knowledge and understanding of topical science **SCN 2-20b**

- Explores items of current scientific interest within the school, local community, nationally or in the global media and collates, organises and summarises findings, with assistance

Links to other SDGs:

No poverty

Quality education



Decent work and economic growth

Reduced inqualities

Clean Water and Sanitation 💧 SDG 6 🛁 Sustainable Development Goals for Kids (youtube.com)

Water is a vital resource that all living beings depend on. Water is used daily for drinking, washing, cooking, hygiene and growing food. However, 785 million people don't have access to drinking-water, and two out of every five do not have a basic facility to wash their hands. Millions of people do not have access to a toilet. By 2025 it's predicted that half of the world's population will be living in areas where demand for water will exceed the supply. Already lack of water affects more than 40% of the world's population.

2 billion litres of wastewater used by humans are discharged every day into the rivers and seas. Every year, 730 billion litres of wastewater is discharged into nature because of leaks, a lack of treatment plants, etc.

Water sanitation refers to the actions that make safe and accessible water available to everyone in the world. If everyone is to have access to safe drinking water within the next few years, pollution needs to be reduced and water sources must be made available in every inhabited place on the planet.

Activity 1: Design and build a water filtration system that can clean a dirty water sample

Using the Engineering Design Process, design and build a water filtration system

Design Water Filters With This Exciting STEM Project! - Science By Sinai

Design a Water Filter STEM PROJECT (youtube.com)

Make a simple water filter experiment (youtube.com)

- **ASK:** Design a water filtration system
  Criteria: your system must filter large particles and smaller particles
  Constraint: you can only use the materials provided

- **IMAGINE:** Research different filtration systems* and what others have done. Think about solutions and draw and explain possible solutions.

  **There are various methods for purifying polluted water. These methods are often combined to achieve better results.*
  ***Coagulation** involves adding chemicals that will cause solids dissolved in water to form clumps that will settle out of the water sample.*
  ***Sedimentation** is when solids are allowed to settle to the bottom of the water sample.*
  ***Filtration** happens when water moves through filters with different pore sizes and different materials designed to remove various dissolved particles and germs.*
  ***Disinfection** kills any remaining parasites, bacteria, or viruses through the use of heat, chemicals, or UV light.*
  *DIY water filters typically focus on **filtration** using various household materials to filter out visible particles from polluted water.*

- **PLAN:** Put trays of the materials in front of the children. Let them decide in their teams what materials they would like to use to filter their water. To challenge the children, you could limit the amount of materials allowed for the design. The children then choose two to three of the best ideas and sketch possible designs (including schematics of the layers), ultimately choosing a single design to prototype.

- **CREATE:** Build a prototype, which aligns with design requirements and that is within the design constraints.

- **TEST:** Evaluate the solution through testing and collect and analyse data; summarise strengths and weaknesses of the design that were revealed during testing.

- **IMPROVE:** Based on the results of the tests, make improvements on the design. Identify changes to make and justify the revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Materials

e.g. sand, pebbles, charcoal, paper towels, cotton wool, coffee filter papers, fabric, sponge, paper, cheese cloth, uncooked macaroni, wood chips, etc

empty plastic water bottles

'Dirty' water (for an example see: Design Water Filters With This Exciting STEM Project! - Science By Sinai)

OR Stop the spread - Practical Action

Design and build a model of a hand washing device that could go in the playground of a school in Kenya to help reduce the spread of disease in the school.

Links to Es and Os and relevant benchmarks:

I have participated in practical activities to separate simple mixtures of substances and can relate my findings to my everyday experience. **SCN 2-16a**

- Draws on findings from practical investigations to explain how a mixture of solids of different sizes can be separated using a sieve or magnet, for example, sand and peas or salt and iron filings.
- Selects the most appropriate practical technique for separating insoluble solids, for example, filtering or sieving..

I can extend and enhance my design skills to solve problems and can construct models **TCH 2-09a**

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

- Builds/simulates solutions to engineering problems.

Links to other SDGs:

Good health and wellbeing

Affordable and Clean Energy 🌍♳ SDG 7 ⚡ Sustainable Development Goals for Kids (youtube.com)

Energy is the ability to make things work. Having access to clean and affordable energy allows communities and individuals to thrive, makes people's lives easier and is an important way out of poverty

Affordable energy means ensuring everyone on the planet has access to adequate energy services regardless of their location and circumstances. Improving energy efficiency is important so that the least amount of energy is used/needed to achieve the best result.

Renewable energy sources allow communities to get access to energy quickly; this is especially important in places where they may not connected to a traditional grid. Renewable energy solutions are becoming cheaper, more reliable and more efficient every day and are crucial to tackling climate change.

To introduce children to the life changing impact of wind power, you could read the story of William Kamkwamba. William grew up in a small village in Malawi that was devastated by famine and drought. Forced to leave school he used donated books in the village library to teach himself how to build a windmill and create electricity which was the first electricity ever seen in his village; he was 14 years old at the time.

Here he talks about the story of his invention that changed his life: William Kamkwamba: How I harnessed the wind | TED Talk

This story comes as a picture book, in a young readers' edition, and in an adult version.

Background information:

Windmills have been around for over a thousand years. They produce energy from the wind when the blade rotates continuously. This moves a motor that does some mechanical work, like lift something. (i.e. they are converting the kinetic energy of the wind into mechanical energy). William's turbine raised water. Windmills can also produce electricity. Windmills typically had four blades.

Wind turbines also use wind energy. The term wind turbine became popular in the 1970s when gas and oil prices started to rise. Much research and development were done then. This research and development show that three blades are optimal. Wind turbines convert the kinetic energy of the wind to electrical energy.

Today, the terms windmill and wind turbine are often used interchangeably by people.

Activity 1: Using the Engineering Design Process, design, a model windmill that can lift something off the floor to the height of the table

Build a Wind Turbine | Windmill #EarthMonth Activities for Kids (youtube.com)

STEM Activity: Design and Make a Wind Turbine (youtube.com)

DIY Wind Turbine Science Project (youtube.com)

- **ASK:** Design a model windmill
  Criteria: it must be able to lift something off the floor to the height of the table
  Constraint: you can only use the materials provided

- **IMAGINE:** research windmills and what others have done. Think about solutions and draw and explain possible solutions.

- **PLAN:** . Choose two to three of the best ideas and sketch and annotate possible designs ultimately choosing a single design to prototype.

- **CREATE:** build a prototype, which aligns with design requirements and that is within the design constraints.

- **TEST:** evaluate the solution through testing and collect and analyse data; summarise strengths and weaknesses of the design that were revealed during testing. *How much weight did your wind turbine lift? Do you think it worked well? E.g. Think about the shape, size, number, thickness and angle of the blades, etc.*

- **IMPROVE:** based on the results of the tests, make improvements on the design. Identify changes to make and justify the revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Materials

Card, straws, paper, cotton reels, cocktail sticks, wooden skewers, dowelling, pencils, Sellotape, plasticine, Blu-tack, string, plastic cups, small containers, split pins, elastic bands, paper clips.

For testing: hairdryer or small electric fan, ruler, pennies or weights e.g. Lego bricks

OR:

Build a miniature wind turbine and measure the electric current produced:

Wind Power! Designing a Wind Turbine - Activity - TeachEngineering

OR:

Build a floating wind turbine:

Floating Wind Model Sheet (bluegemwind.com)

Activity 2: Build a waterwheel

Background information:

Water wheels are large wheels powered by either flowing or falling water and used to work machinery for e.g. grinding grain into flour, pumping water to a higher level, powering saws to saw wood etc. They convert the energy of flowing or falling water (kinetic energy) into useful power, typically in the form of rotational motion. The modern water wheel dates back to the 19th century and was developed by Michael Faraday. His invention is still used today for hydroelectric power generation.

Water wheels can also be used to generate electricity: by using flowing water (hydropower generation) or by using falling water (tidal power generation).

A typical water wheel consists of three main components:

- **Blade or bucket:** This is the part of the wheel that takes the kinetic energy from the falling water.
- **Wheel:** The wheel is the part of the system that the bucket is attached to. This is the part that rotates.
- **Axle:** The axle acts at the fulcrum which holds the wheel in place during rotation.

There are lots of different ways you can build a waterwheel:

#WhatsInMyTray - STEM Project - How to make a water wheel (youtube.com)

DIY Water Wheel STEM challenge (science-sparks.com)

DIY Water Wheel For Kids - Little Bins for Little Hands

Or use the Engineering Design Process and design and create your own.
What happens when you increase/decrease the flow of the water?

Try using the power of water to move an object in the same way that water turbines create sustainable energy:

https://www.youtube.com/watch?v=ziU6Krb3YiE

How to make a Water Wheel | Science Activity for Kids | Let's Go Live with Maddie & Greg (youtube.com)

How to make a Water Wheel - Let's Go Live (letsgolivescience.com)

Links to Es and Os and relevant benchmarks:

By considering examples where energy is conserved, I can identify the energy source, how it is transferred and ways of reducing wasted energy. **SCN 2-04a**

- Demonstrates understanding of the law of conservation of energy (energy can be converted from one form to another but cannot be created or destroyed)

I have investigated different water samples from the environment and explored methods that can be used to clean and conserve water and I am aware of the properties and uses of water. **SCN 2-18a**

- Discusses the many uses of water, for example, to support all living things, in preservation (ice) and to generate electricity

I can extend and enhance my design skills to solve problems and can construct models **TCH 2-09a**

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

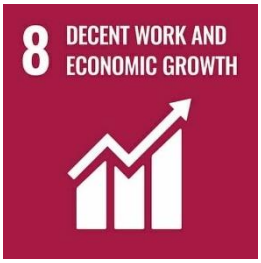
- Builds/simulates solutions to engineering problems.

Links to other SDGs:

No poverty

Sustainable cities and communities

Climate action



Decent Work and Economic Growth 📈 SDG 8 💼 Sustainable Development Goals for Kids (youtube.com)

A job is something that is done in exchange for a wage or salary. When we talk about decent work, we mean work that offers dignity to the person doing it, is appropriately paid, is safe, has equal opportunities and treatment for all and is without discrimination of any kind.

Decent work is the way out of poverty, since many people are unemployed and many others, even if they have a job, do not receive a sufficient enough salary to pay for their basic needs and are therefore struggling to have a decent life.

1/5 of young people are not in education, training or employment

Activity 1: List as many STEM careers that the children can think of and discuss the pathways needed to get involved in those careers.

The learners could research the skills and qualifications needed for these particular careers and the different pathways they could take e.g. apprenticeship, college, university, graduate schemes and training programmes etc.

The children could create questions and interview e.g. parents, carers, members of the local community and /or STEM Ambassadors (https://www.stemambassadors.scot/ https://www.stemambassadors.scot/schools-community-groups) who do the jobs identified on the list.

It might be possible to invite someone in from the local college and/or senior pupils who are involved in Foundation Apprenticeships to come and speak to the class.

This might be useful too:

- Educators | My World of Work
- My World of Work |

There are lots of ways in which the learners could share their learning. Some examples are:

- Create a 'recruitment video' for a particular job
- Role play – this could include creating a video using a green screen
- Create a wall display
- Write an advertisement for a particular job

- Make a poster advertising one of the jobs
- Create a class book about the different jobs/careers
- Drama – create props and a scenario to act out a 'day in the life' of a person of a chosen job
- Create a multimedia presentation using images, text and sound files to tell the story of a chosen job.
- Creative writing – write a fictional story about an event that happens when a person doing a chosen job goes to work, and what he/she has to do and what skills he/ she needs to use to solve the problem

You could also use **Activity 1: Paper Bag Game** (taken from Teaching Resources | Concern Worldwide *see pages 8 – 11) from* ***page 7*** *of this resource booklet* to show how hard some people work but yet earn so little.

Links to Es and Os and relevant benchmarks:

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

I am investigating different careers/occupations, ways of working, and learning and training paths. I am gaining experience that helps me recognise the relevance of my learning, skills and interests to my future life. **HWB 2-20a**

- Identifies connections between skills and the world of work.
- Uses investigative skills to gain more information about jobs / careers.

NOTE: Depending on the tasks undertaken, there will be links to other Es and Os

Links to other SDGs:

No poverty

Responsible consumption and production

Industry, Innovation and Infrastructure 🏭 SDG 9 🏭 Sustainable Development Goals for Kids (youtube.com)

Industry is the process of turning raw materials into finished products, or a particular business that does this.

Innovation is the changes and improvements in processes that make people's lives easier. Innovation could be a new idea, product or a different way to do something.

Infrastructure is all the basic systems that have been created in a country, especially through technology and engineering, which allow it to function well and to develop. Roads are a very important part of a country's infrastructure. Without roads, it is difficult for people to travel and to work and to move products from one place to another.

Different criteria are used by different organisations to measure how 'green' a city is, but they usually include the percentage of public green spaces, how much energy is supplied from renewable energy, how much of the population use public transport to get to work, level of air pollution, availability of recycling and water consumption.

Roads, water, electricity and sanitation facilities are still scarce in many developing countries.

Activity 1: Build the strongest bridge possible

What makes bridges so strong?: https://www.youtube.com/watch?v=oVOnRPefcno

STEM Challenge: Build a Bridge (youtube.com)

Design & Build Paper Bridges (youtube.com)

Materials:

A4 paper
Weights for testing e.g. small weights, pennies, marbles, small rocks etc.
Books for the bridge supports

Begin by introducing the concept of bridges and their importance in transportation and infrastructure.

Background information:

A bridge is any structure that allows transport, people etc. across an obstacle e.g. road, river, canal etc.; it is up to engineers to design and build them so that they can carry the weight.

A bridge has two types of load that it needs to carry. These are:

Dead load – this is the bridge's own weight, which doesn't change, its weight stays constant

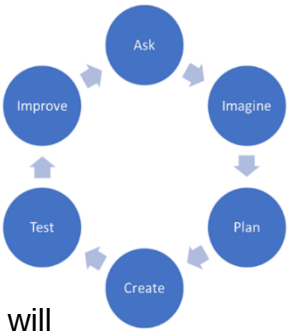
Live load – this is the weight of what the bridge is carrying, which changes continually

These loads cause the bridge to have to deal with various forces. To design a bridge, an engineer must understand the forces of tension and compression that act on every bridge. A bridge uses tension and compression to balance itself and keep it standing. These two opposing forces work together to create an equilibrium in a bridge's structure. A bridge will buckle or bend if compression, the force pushing down on it, becomes too much and it will snap if tension, the force pulling on it, overwhelms.

Explain the terms 'compression' and 'tension' to the pupils and find some everyday examples to demonstrate these. For example, if you stretch an elastic band as far as it can go, the force that is working is called tension. When you squeeze a sponge or stand on a pile of books, that force is called compression. Explain to the children that while bridges have to be very strong to withstand these forces, they also use these forces to make them stronger.

Working in groups, ask the children to think about the bridges that are located in the local area. Provide the children with maps of the area and ask them to locate where a bridge appears on it. When you have located a bridge on the map, ask the children to discuss in groups why they think the bridge was built at that particular location. Lead the children to consider things such as the width of the gap in the landscape, the height of the land and access to the two ends of the bridge and discuss this in relation to the importance of infrastructure and roads etc. Without roads and bridges, it is difficult for people to travel and to work and to move products from one place to another.

Using the Engineering Design Process,



- **ASK:** Design the strongest bridge possible
  Criteria: Your bridge must be freestanding and span a distance of 15 cm and be able to supports several weights
  Constraint: you can **only** use 2 sheets of A4 paper per bridge design

- **IMAGINE:** Think about how to use paper in different ways that will make it stronger. Think about the shapes used in bridges. Draw and explain possible solutions.

- **PLAN:** Choose two to three of the best ideas and sketch possible designs, ultimately choosing a single design to prototype.

- **CREATE:** Build a prototype, which aligns with design requirements and that is within the design constraints.

- **TEST:** Evaluate the solution through testing and collect and analyse data; summarise strengths and weaknesses of the design that were revealed during testing. Once the paper folds and collapses and touches the surface of the table it is

a ‘failure’. To improve the design and test it again, you will need a new sheet of paper.

- **IMPROVE:** Based on the results of the tests, make improvements on the design. Identify changes to make and justify the revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Test several different designs and keep improving your design! Record the weight hat each bridge can hold – can you improve your best design in any way?

Can you increase the challenge by making the span longer or having a minimum weight the bridge has to hold?

Activity 2: Be an inventor! The Most Magnificent Thing Design Challenge

Sometimes engineers invent new things, and sometimes they improve existing things. What does it mean to ***innovate***? *(to propose or implement a new method, approach, idea; make inventive changes).*

Any invention or product starts with an idea. Ideas can be wild and impractical or realistic and useful. Discuss with the children what kinds of STEM jobs are related to designing and building new products and toys.

Steve Sasson invented the digital camera. When he was a child, Sasson built a box with lights that flashed. He showed it to his father who asked what it did, and Sasson responded, “nothing” so it became known as the “Do Nothing” box, but the process of turning the idea into a prototype and then sharing it was significant.

Find out more about the “Do Nothing” box: Inventor Showcase

The Most Magnificent Thing Design Challenge

Read the story **"The Most Magnificent Thing"** by Ashley Spires or watch and listen to it:

The Most Magnificent Thing by Ashley Spires (youtube.com)

This story is about a girl who decides she wants to make the most magnificent thing, but it is harder than she realize.

The story illustrates the Engineering Design Process: the girl has an idea about something that will make something better, or a challenge and she sets out to build the solution that she can picture, then there are many rounds of building, testing and evaluating, and building again to improve the design. This is the Engineering Design Process in action!

Ask the children to create an invention to solve a real world problem or a problem in the local community or school;/classroom. This could be something as simple as a squirrel proof bird feeder or something to help keep resources tidy in the classroom!

These links might be useful for helping to generate ideas:

https://www.youtube.com/watch?v=OpBTvhlLEzI&t=16s

Little Inventors: How to think up invention ideas! (youtube.com)

Little Inventors

OR

Activity from:

STEM Activity: Invent Something from Nothing | National Inventors Hall of Fame®

Take turns filling in the blanks to complete the sentence:

I wish I had a _____ that could _____ .

If you need, fill in the first blank with an object, such as a toy:

Examples:
I wish I had a scooter that could _____.
I wish I had a ball that could _____.
I wish I had a watch that could _____.

The children should make annotated drawings of some of their ideas for an invention.

Provide a variety of materials such as: play dough, craft items (e.g., patterned paper, fabric scraps, stickers), drawing materials (crayons, markers, pencils), paper, string, paper clips, pipe cleaners, lollypop sticks, recyclables (e.g., cardboard, plastic containers etc.) or other unused objects around the classroom, sticky tape and/or glue

KAPLA blocks or Makedo kit could also be used

Using the Engineering Design Process, pick one idea from the activities above and design and create a model of the invention.

Activity 3: Enter an inventors' competition!

- If you were an engineer what would you do? About - Leaders Award : the children create their own design of a solution to a real-world problem
- Homepage - Kids Invent Stuff a new invention challenge is set every month, each with a new theme and the winning invention idea is then built by engineers and shared on their YouTube channel

Links to Es and Os and relevant benchmarks:

I can extend and enhance my design skills to solve problems and can construct models
TCH 2-09a

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.

- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

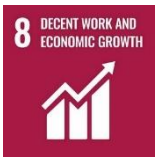
- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

- Builds/simulates solutions to engineering problems.

Links to other SDGs:

No poverty



Decent work and economic growth

Sustainable cities and communities

Reduced Inequalities 📈 SDG 10 🔁 Sustainable Development Goals for Kids (youtube.com)

When we talk about inequality between people, we mean the different treatment that some people get compared to others. This may be due to the economy, race, sex, gender, gender identity, sexual orientation, class, religion, age or physical disability. Inequality is one of the things that causes poverty, malnutrition, and hunger.

Gender inequality occurs when a person does not have access to the same opportunities as another person of a different sex. Throughout history, this situation has particularly affected women, who have suffered worse working and social conditions than men.

Activity1: Gender inequality in the Olympic Games

One area that gender inequality affects women is in sport.

KS2 Ancient Greece: 4. The Olympic Games (but not as we know them) - BBC Teach

The history of the Olympic Games - BBC Bitesize

Research the history of the Olympic games, including gender inequality experienced by women. It was 1900 before the Olympic Games accepted women competitors. By 1972, women could only compete in about half of the events. By the 2016 Summer Olympic Games, there were more opportunities for women to compete than ever before but there were still more men's events (161) compared to women's and mixed events (145): mixed events include men and women.

Find out about how many men's, women's and mixed events there will be at the next Summer Olympic games (or the last Summer Olympic games)

Are there any male-only or female-only events?

Are there any events where men and women can independently compete against each other?

How does this compare to previous Summer Olympic games?

Research the numbers of male and female athletes from different nations competing in the most recent Olympic Games. Compare different nations and discuss why some nations might have more men participating than women.

Investigate data from previous Olympic Games to explore how the participation of women has changed over time:

Summer Olympics: number of athletes by gender 1896-2020 | Statista

Gender equality through time: at the Olympic Games (olympics.com)

Use the data from these activities to create e.g. a table, graph, etc.

Activity 2: Find out about famous women Olympians

Research famous women Olympians and find out about their careers and their achievements.

For example:

- Nicola Adams
- Kathrine Switzer
- Serena and Venus Williams
- Shelly-Ann Fraser-Pryce
- Dame Laura Kenny

The children could present their research as e.g. a film, a play, a digital book, a PowerPoint or Sway presentation, a poster etc.

Links to Es and Os and relevant benchmarks:

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way. **MNU 2-20b**

- Collects, organises and displays data accurately in a variety of ways including through the use of digital technologies, for example, creating surveys, tables, bar graphs, line graphs, frequency tables, simple pie charts and spreadsheets.
- Analyses, interprets and draws conclusions from a variety of data.

I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs, making effective use of technology. **MTH 2-21a / MTH 3-21a**

- Displays data appropriately making effective use of technology and chooses a suitable scale when creating graphs.

Links to other SDGs:

No poverty

Good health and wellbeing

Gender equality

Decent work and economic growth

Sustainable Cities and Communities SDG 11 Sustainable Development Goals for Kids (youtube.com)

Sustainability is about meeting the needs of people today but at the same time growing the economy without compromising the needs of future generations or endangering the environment. Sustainable cities are those that offer a good quality of life to the people living there without putting their resources at risk. Sustainable cities guarantee the rights of their residents to, for example, adequate and safe housing, access to green spaces, quality and adequate public transportation, to protection of cultural heritage etc.

Half of humanity — 3.5 billion people — live in cities today, and this number will continue to grow. Because the future will be city or town living for the majority of people, the solutions to poverty, climate change, healthcare, education must be provided in city life.

Activity: My Green City

KS2-Designing for sustainability and the environment | STEM

This resource comprises four lessons in which children work in teams to design a sustainable city. They explore examples of sustainability in existing cities around the world (including exploring different cities using Google maps) and think about the needs of citizens and the challenges involved in supporting a growing urban population. Children then plan their city and decide what things are essential to their plan (e.g. houses, office buildings, shops, restaurants, bank, hospital, police station, fire station, cinema and entertainment, museum, sports arena, library, school, university, train station, bus station, airport, places of worship, supermarkets, factories, warehouses, recycling centre, sources of energy, food growing areas, natural spaces). They then create a model of it and share their designs with each other, explaining how inhabitants can live sustainably.

Or design and build either a mini town using makedo where the children are town planners and work in engineering teams to make citizens, vehicles, buildings and renewable energy sources:

Classroom Snapshots: The Town That Takes Care Of The Planet – Makedo Hub

Links to Es and Os and relevant benchmarks::

I can discuss the environmental impact of human activity and suggest ways in which we can live in a more environmentally responsible way. **SOC 2-08a**

- Suggests at least three ways in which people can live in a more environmentally responsible way.

I can explain how the physical environment influences the ways in which people use land by comparing my local area with a contrasting area. **SOC 2-13a**

- Provides explanation as to why their local physical environment influences the way in which people use land in comparison to a contrasting areas.

Through exploring non-renewable energy sources, I can describe how they are used in Scotland today and express an informed view on the implications for their future use.
SCN 2-04b

- Draws on increasing knowledge and understanding to suggest ways in which they can reduce their own energy use and live more sustainably.

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

I can extend and enhance my design skills to solve problems and can construct models
TCH 2-09a

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

Having investigated where, why and how scale is used and expressed, I can apply my understanding to interpret simple models, maps and plans. **MTH 2-17d**

- Interprets maps, models or plans with simple scales, for example, 1 cm:2 km.

Links to other SDGs:

No poverty

Good health and wellbeing

Affordable and clean energy

Reduced inequalities

Climate action

Responsible Consumption and Production ☎ SDG 12 🌍 Sustainable Development Goals for Kids (youtube.com)

Both consumption and production need natural resources which come from the environment. Today's way of life uses a lot of resources; this is having a negative impact on the planet and endangering natural resources. It is very important therefore to use sustainable and renewable energy sources, as well as to have responsible consumption of both energy and the resources that the Earth provides. Many of these resources are non-renewable (we don't have an endless supply), cause harm when they are extracted and pollute our planet when they are consumed or discarded.

Conflict can be caused by many things but one of the causes is linked to the struggle for control of natural resources such as land, oil, precious metals and water. Tensions can arise between those who live on the land and companies who wish to extract resources for the manufacture of goods.

Food waste is a huge problem across the world: one third of the food produced for people to eat ends up lost or wasted, i.e.1.3 billion tonnes per year.

Activity 1: Biodegradable Waste

This activity is taken from: Waste Investigators: part of the British Science Association's National Science & Engineering Week activity pack series.

Not all materials can be recycled. Some materials don't degrade/decompose quickly or easily and take many years to degrade in landfill sites. Biodegradable materials can be broken down by things like light, water and microorganisms.

This investigation involves 2 types of packing materials:

- **Packing peanuts**: these are made from a natural, renewable resource that comes from plants and degrade easily in wate. In landfill sites, bacteria and other micro-organisms can then degrade the starch and remove the waste. Packing peanuts are a sustainable product that do not cause harm when disposed of.
- **Styrofoam packaging:** is made of plastic and degrades slowly over many years and is not widely recyclable.

What you need:

- Styrofoam packaging
- Starch-packing peanuts
- Four bowls (labelled 1-4)
- Stopwatch,
- Water, vinegar, salt and detergent

Styrofoam packaging

Packing peanuts

Method:

1. Pour 100 cm3 of water into each bowl.
2. Mix salt into bowl one, detergent into bowl two and vinegar into bowl three. Bowl four should only contain water.
3. Put two starch packing peanuts and two Styrofoam pieces into each bowl.
4. Start the stopwatch.
5. Time how long does it take for each piece of packing to dissolve. In which bowl does the packaging dissolve the quickest/slowest?
6. Wait for 30 minutes. Is there any change? Try stirring the water.

Try tearing the packaging into pieces; this will increase the surface area of the pieces. How does this affect the rate at which the packaging dissolves?

What happens if you use hot water?

Increasing the surface area of the waste packaging exposes more of it to the solvent (any of the liquids). This should increase the rate at which the packaging dissolves. Hot water should also speed up the dissolving rate.

Activity 2: Plastics Challenge

This activity is taken from : *Plastics challenge - Practical Action where you will find lots of teacher and pupil resources to support the delivery of this and other activities.*

The increased use of plastics globally is creating huge environmental problems. The children are challenged to address the problem of waste plastics by designing a product (or

range of) that could help the Hamro Mahila Women's Group in Nepal to increase their range of products to sell for a local or international market'. The women have the use of a sewing machine, an iron and basic craft tools. The products need to be made cheaply whilst being safe to use. You need to decide whether this product will be sold locally or internationally. In either case you will need to consider how this might affect the design characteristics.

The Hamro Mahila Women's Group was set up after a group of women 'waste' collectors were trained in making crafts from 'waste' plastic. Their enterprise enables them to earn money to buy food and pay for school fees for their children.

Use the Engineering Design Process:

- **ASK:** Design a product from 'waste' plastic
  Criteria: your product must be safe to use and appealing
  Constraint: your product must be made from 'waste' plastic and be cheap to make

- **IMAGINE:** Learn from other designers and makers and research new products created from 'waste'/recycled materials e.g. plastic bottle vases**,** aprons and bags made from fused plastics and crisp packets, bags, baskets and placemats made by weaving or knitting plastics etc. Who will your product be for? Sketch some ideas.
  Precious Plastic Universe: a big bang for plastic recycling (youtube.com)
  A Big Bang for Plastic Recycling (preciousplastic.com)

- **PLAN:** Choose two to three of the best ideas and draw and annotate possible designs, ultimately choosing a single design to prototype.

- **CREATE:** Build the prototype, which aligns with design requirements and that is within the design constraints.

- **TEST:** Evaluate the design by testing and collect and analyse data; summarise strengths and weaknesses of the design that were revealed during testing.

- **IMPROVE:** Based on the results of the tests, make improvements to the design. Identify changes to make and justify the revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Links to Es and Os and relevant benchmarks:

I can extend and enhance my design skills to solve problems and can construct models **TCH 2-09a**

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. **SCN 2-20b**

- Shares opinions about a variety of topical scientific issues considering, for example, moral, ethical, societal, cultural, economic and environmental aspects.

Background information:

Plastic is a really useful man-made material that has transformed our lives, but what happens when we have finished with it and throw it away is causing a big problem for the planet.

Plastic is lightweight, strong and waterproof, which makes it ideal is for making durable products that last a long time but these properties also make it a problem for the environment.

Most plastics cannot *biodegrade*, which means it doesn't rot, like paper or food. Instead, plastic waste can last for a very long time after it is thrown away, sometimes hundreds of years, spoiling beaches, hurting wildlife and contaminating our food. More than eight million tonnes of plastic pollute the world's oceans each year alone.

Some plastic objects are only used once then thrown away. These are called single-use plastics. They include things such as plastic bags, bottles, straws and crisp packets.

Bioplastics are made from things such as corn starch, sugar, potatoes, plants etc. and could potentially be replacements for plastics made from petroleum and natural gas. Bioplastics are biodegradable. By changing the amounts of the ingredients, the plasticity and flexibility of the plastic can be altered.

Activity 2: Make plastic from seaweed

Seaweed-Based Packaging for People and the Planet — GreenWave

https://www.bbc.co.uk/news/uk-wales-59264278

How To Make A Seaweed Bioplastic - The Basics (youtube.com)

You will need:

Bladderwrack seaweed or any brown seaweed (or bladderwrack powder https://amzn.eu/d/fJ3SWe3)
250g cornflour
750ml water
2 tablespoons glycerine
Measuring jug
Saucepan
Tablespoon
Baking tray
Scales

What to do:

1. Dry the seaweed, break it into pieces and use a blender to make it into a powder
2. Take 50g of powdered seaweed and add 250ml of water and mix in the blender and put this into the saucepan
3. Mix 250g of cornflour with 500ml of water and add this to the seaweed mix in the saucepan
4. Add 2 tablespoons of glycerine to the pan
5. Heat on a gentle heat, mixing continuously until it turns into a gel; this takes 20 – 30 minutes
6. Spread the gel thinly onto an upside down baking tray and leave to dry
7. Gently peel it off the baking tray when dry.

Activity 3: Make plastic from milk

Make Plastic From Milk - A Bioplastics STEM Project For Kids (steampoweredfamily.com)

Plastic from milk is also known as casein plastic and is the way they used to make plastics before 1945 when synthetic plastics were introduced.

You will need:

A hob or microwave to warm the milk
Milk (a lower fat content is better)
White vinegar or lemon juice
Bowl or saucepan
Teaspoon
Strainer (or use cheese cloth or similar)
Paper towel
Tools for shaping or silicone moulds

What to do:

1. Take 285ml of milk and heat in a saucepan or in the microwave in a heat resistant bowl. When it just starts steaming, remove from the heat.
2. Add 4 tsp of vinegar or lemon juice and stir gently; it will immediately begin to curdle forming curds and whey
3. Stir gently for approximately one minute for the full reaction to finish and all the curds to form. Don't stir aggressively - be gentle
4. Strain off the whey using the strainer or you use cheese cloth (or similar) and let it drip for a few minutes until most of the liquid has drained off. Gently stir the curds around in the strainer if needed.
5. Remove the curds and place them on to layers of paper towel. Carefully pat and squash them to remove more liquid. You may need to replace the paper towel and repeat a few times as you need to remove as much of the liquid as possible. The result is a crumbly substance which can be squashed and shaped.
6. Put it into the moulds if you are using or shape it by hand/using the tools.
7. For a smoother final product, before shaping/putting into the moulds, put it into a bowl and soak it in vinegar for about an hour, then repeat the straining and drying process using the paper towels. This will give a smoother texture and it will be less crumbly.
8. Now put into the moulds, shape by hand, roll it into beads, or flatten it and cut shapes using cookie cutters.
9. Leave to dry – this can take about 2 days. The shapes can be removed from the silicone moulds after 24 hours to speed up the drying process.
10. Once dry it will be hard plastic. If the edges of the shapes need to be tidied up, then this can be done with fingers or sand paper etc.
11. Now the shapes can be painted using acrylic paint and coated in clear varnish once they are finished.

Activity 4: Make plastic from cornstarch

bioplastics production at home | corn based plastic | bioplastic (youtube.com)

You will need:

1 tablespoon of cornstarch (not corn flour) https://amzn.eu/d/6HYseVz
1.5 tablespoons of water
4 drops of cooking oil
Pipette
Tablespoon
Food colouring (optional)
Microwaveable container
Microwave

What to do:

1. Put the cornstarch in the container
2. Add the cooking oil using the pipette
3. Add the water
4. Mix it together until it until it is smooth and looks like milk (If you want the plastic to be coloured, you can add food colouring)

5. Put into the microwave heat on high for 30 seconds
6. Allow to cool and remove from the container

The children could discuss the 'pros' (*biodegradable, made from renewable sources etc.*) and 'cons' (*single use as they are biodegradable, so a lot will have to be made, what happens if we start to take e.g. a lot of seaweed out of the oceans, or have to use a lot of e.g. milk or corn or potatoes to make plastics How might this affect food availability for cattle or us? etc.*) of bioplastics.

Links to Es and Os and relevant benchmarks:

Through carrying out practical activities and investigations, I can show how plants have benefited society. **SCN 2-02b**

- Relates findings from practical investigations to describe how plants have benefited society, for example, in medicine, dyes, fuels, construction, prevention of soil erosion and by influencing the balance of gases in the air.

I have collaborated in activities which safely demonstrate simple chemical reactions using everyday chemicals. I can show an appreciation of a chemical reaction as being a change in which different materials are made. **SCN 2-19a**

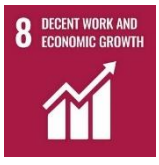
- Uses prior knowledge to identify when a chemical reaction has occurred to produce a new substance *****

***** *bioplastic in the above activities*

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. **SCN 2-20b**

- Shares opinions about a variety of topical scientific issues considering, for example, moral, ethical, societal, cultural, economic and environmental aspects.

Links to other SDGs



Decent work and economic growth

Sustainable cities and communities

Responsible consumption and production

Climate action

Life below water

Climate Action ☼ SDG 13 🌡 Sustainable Development Goals for Kids (youtube.com)

Climate is what we expect the weather conditions to be like at a certain time in a certain place (e.g. hot and sunny in the south of Spain in summer, cold and rainy in Scotland during winter etc.). Climate change is the long term shift in weather patterns across the planet or in average temperatures; as the average temperature of the planet increases, weather patterns are changing.

Each year is getting hotter than the last and the levels of carbon dioxide and other greenhouse gases continue to rise. Climate change is affecting all countries; sea and ocean levels are rising and weather phenomena are becoming more extreme. Flooding and drought caused by changing weather patterns are having devastating impacts in the UK and the world.

Activity1: Modelling melting polar ice caps

Background information:

Earth is the only planet we know of so far where water can be found in the form of a gas, a liquid or a solid. When scientists look for life on other planets, they usually look for water as an indicator of life.

There are huge sheets of ice at the North and South poles of our planet. The ice, because it is white, reflects the warmth of the sun back into space helping to keep the planet cool. As the ice melts due to global warming, the water absorbs the heat from the sun because it isn't reflected back into space anymore, which is helping to the increase the temperature of our planet. Fresh water from melting ice sheets changes the salinity of the oceans and affects the ocean currents and conditions for wildlife.

Discussion The Impact of Melting Ice Caps on Polar Marine Life (youtube.com)

As a glacier melts, a river or lake may form at its end and contact with the water causes the ice to melt more quickly.

Why ice melts: Changes of state always involves a transfer of energy. Ice melts when heat energy causes the frozen water molecules to move faster. When ice comes into contact with warmer air or water, it absorbs the surrounding energy (heat). The air and water molecules bump against the ice molecules and transfer some of their energy. The increased energy causes the ice molecules to break away, and the water changes state from a solid to a liquid.

Ice melts more quickly in water than air because water is denser – has a greater concentration of molecules – than air. When ice is in water, more molecules bump against it and transfer more heat energy.

You will need:

Two identical plastic containers or one divided container
Ice cubes
Water at room temperature
Food colouring (optional)
Timer or stopwatch

What to do:

1. Place an equal number of ice cubes in each container. You could use ice cubes made with coloured water: the colouring makes no difference to the melting but it makes it easier to see the ice as it melts.
2. Add a small amount of water to one of the containers.
3. Set the timer or stopwatch and observe the containers every few minutes to see what is happening.
4. While the ice is melting, you could watch videos of glaciers melting or collapses (for example, Chasing Ice, Part of Perito Moreno glacier collapses or Franz Josef timelapse retreat).
5. Record the time it takes for the ice to melt in each container.

Ask the children:

1. What difference did contact with water make to the ice cubes ?
   Contact with water causes ice to melt more quickly.

2. Why does ice melt faster when it is in contact with water than with air?
   When ice comes into contact with warmer air or water, it absorbs the surrounding energy (heat). Water is denser than air, so its molecules transfer heat at a faster rate than air.

Activity 2: Demonstrate how melting ice caps and sheets lead to sea levels rising.

Melting Ice Experiment: Discover How Ice Impacts Sea Levels | TheDadLab Climate Science (youtube.com)

How Do Melting Polar Ice Caps Affect Sea Levels? | STEM Activity (sciencebuddies.org)

OR

Investigate which type of ice (land ice or sea ice) contributes more to rises in sea level:

Student Project: How Melting Ice Causes Sea Level Rise | NASA/JPL Edu

Sea Level Rise Part II: Land and Sea Ice Experiment (youtube.com)

The ice is melting - Teacher guide.pdf (stem.org.uk)

This resource has four activities in which pupils will explore the impacts of global warming and melting ice on the Earth.

They learn the difference between land ice and sea ice and investigate the respective effects of these melting. They then design their own experiment to examine how melting ice changes the temperature of the atmosphere. Pupils finish by learning about glaciers, and by looking at satellite images of a glacier to think about how much it has melted over a period of time.

Links to Es and Os and relevant benchmarks:

I can apply my knowledge of how water changes state to help me understand the processes involved in the water cycle in nature over time. **SCN 2-05a**

- Demonstrates understanding of the processes involved in the water cycle.

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. **SCN 2-20b**

- Shares opinions about a variety of topical scientific issues considering, for example, moral, ethical, societal, cultural, economic and environmental aspects.

I can discuss the environmental impact of human activity and suggest ways in which we can live in a more environmentally responsible way. **SOC 2-08a**

- Identifies at least three impacts of human activity on the environment.

Activity 3: Create an animal tracker using the micro:bit

Animal tracker | micro:bit (microbit.org)

Use the micro:bit's accelerometer and radio features to make a prototype of a device to help scientists track polar bears or other animals to discover how climate change is affecting them.

Links to Es and Os and relevant benchmarks

I can create, develop and evaluate computing solutions in response to a design challenge **TCH 2-15a**

- Creates programs in a visual programming language including variables and conditional repetition.
- Identifies any mismatches between the task description and the programmed solution, and indicates how to fix them

Links to other SDGs

Sustainable cities and communities

Responsible consumption and production

Life below water

Life Below Water SDG 14 Sustainable Development Goals for Kids (youtube.com)

Underwater life is the set of ecosystems that exist in seas and oceans. We rely on oceans and seas to provide us with food, energy, oxygen and water. Seas and oceans act as the planet's climate regulator too.

The oceans cover three quarters of Earth's surface and contain 97 percent of the planet's water. The oceans and seas are home to 250,000 species of living things, and scientists believe that there are still many more to be discovered. The rising temperature of our planet is affecting the oceans which is endangering the survival of many marine animals.

The oceans have also become a waste bin, with common household items including plastic bottles, plastics bags, cigarettes, food wrappers, plastic utensils, straws, beverage cans, paper bags and Styrofoam cups floating in our oceans.

The water of the oceans and seas is becoming more acidic because of the increased amount of carbon dioxide in the atmosphere due to human use of technology and the burning of fossil fuels: the ocean absorbs about 30% of the carbon dioxide in the atmosphere. This increased acidity of the ocean and seas causes major problems for marine organisms and the ecosystem. Climate change: How ocean acidification harms coral reefs - BBC Newsround What Is Ocean Acidification? | NASA Climate Kids

Activity 1: Using a micro:bit build a prototype of beach lighting for paths that guides humans safely but doesn't distract turtles

Newly hatched sea turtles use moonlight to find their way to the sea. Tall, bright lights can confuse them. Build a prototype of beach lighting for paths that guides humans safely but doesn't distract turtles.

Saving sea turtles introduction (youtube.com)

Saving sea turtles | micro:bit (microbit.org)

Links to Es and Os and relevant benchmarks

I can create, develop and evaluate computing solutions in response to a design challenge
TCH 2-15a

- Creates programs in a visual programming language including variables and conditional repetition.

- Identifies any mismatches between the task description and the programmed solution, and indicates how to fix them

Activity 2: Design and create a tool to help clean up a (mock) oil spill

The challenge: become environmental engineers and using the Engineering Design Process, design and create a tool that will successfully clean up oil from water.

The children will notice that oil and water don't mix: a useful explanation why is available here: Pop Up Science: Oil and Water (youtube.com)

Use the Engineering Design Process:

- **ASK:** Design a tool to clean up an oil spill

  Criteria: you must only take out the oil and as little water as possible
  Constraints:
  - your tool must not push the oil further into the water
  - you must not contaminate areas outside of the oil spill
  - oil and the materials used to take the oil out of the water must be placed in a plastic cup for proper disposal

- **IMAGINE:** Research oil spills and how they are cleaned up**.** Look at the materials provided and think of ways to clean up the oil and sketch some ideas
  How Do We Clean Up Oil Spills? (youtube.com)
  How to Clean Up an Oil Spill (youtube.com)
  OIL SPILL CLEANUP METHODS | Floating Booms, Skimming, Sorbents, Burning In-Situ| Grade-8|Tutway | (youtube.com)
- **PLAN:** Choose two to three of the best ideas and draw and annotate possible designs, ultimately choosing a single design to prototype.

- **CREATE:** Build the prototype, which aligns with design requirements and that is within the design constraints.

- **TEST:** Evaluate the design by testing and collect and analyse data; summarise strengths and weaknesses of the design that were revealed during testing.

- **IMPROVE:** Based on the results of the tests, make improvements to the design. Identify changes to make and justify the revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Each group will need a small tub of water – a clear container works best so that the children can see where all the oil goes.

Fill the tub ½ full of water.

Mix two to three tablespoons of vegetable oil with a teaspoon of cocoa powder and pour into the tub of water – this is the oil spill.

Materials: cottonwool balls, wool, sponge, tights, scissors, lollipop sticks, paper towel

Plastic cup for oil disposal

Links to Es and Os and relevant benchmarks:

I can extend and enhance my design skills to solve problems and can construct models **TCH 2-09a**

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

- Builds/simulates solutions to engineering problems.

Links to other SDGs

Responsible consumption and production

Climate action

Life on Land SDG 15 Sustainable Development Goals for Kids (youtube.com)

An ecosystem is a community of living things and their environment. It includes both living (e.g. plants and animals) and non-living things (e.g. water, soil, rocks etc). Ecosystems can be as small as a garden or as large as the ocean!

On planet Earth there are many types of ecosystems, both aquatic and terrestrial. Terrestrial ecosystems are those that are on land and include deserts, forests and jungles. Forests help to clean up air pollution and are home to more than 80% of all terrestrial species of animals, plants and insects. Millions of people living in or near forests depend on them for their livelihoods. Due to forest clearance, 13 million hectares of forest disappear every year, putting the preservation of biodiversity at risk.

Activity 1: Research an endangered animal or bird

https://www.stem.org.uk/resources/elibrary/resource/34178/story-extinction

22% of known animal species are at risk of extinction. The children choose an endangered animal to research (lifestyle, habitat, what it eats etc.) including the reasons why it is at risk of extinction.

They could present their research as e.g. a film, a digital book, a PowerPoint or Sway presentation, a poster etc. or create a classroom display.

Discuss with the children what is causing the risk to these animals or birds e.g. habitat changes, natural disasters, changes in the climate, human activity, habitat clearance, hunting, poaching , an invasive species etc. Can they suggest actions they could take to help address these issues?

Links to Es and Os and relevant benchmarks

I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. **SCN 2-01a**

- Identifies characteristics of living things and their environment which have contributed to the survival or extinction of a species
- Describes how some plants and animals have adapted to their environment, for example, for drought or by using flight.

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. **SCN 2-20b**

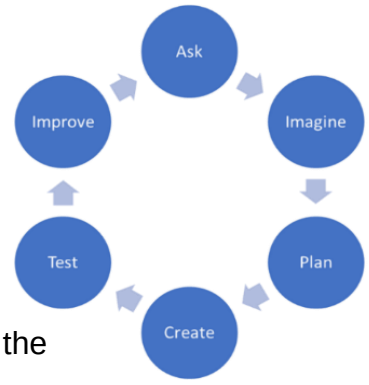
- Shares opinions about a variety of topical scientific issues considering, for example, moral, ethical, societal, cultural, economic and environmental aspects.

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

- Uses search engines to search the internet for specific or relevant information for example, using quotation marks to narrow the results.
- Access websites and use navigation skills to retrieve information for a specific task

Activity 2: Use the Engineering Design Process to design and build a bird feeder

Attract more birds to your school grounds to learn about and support the biodiversity of your local area.



- **ASK:** Build a bird feeder that attracts more birds to the school grounds
  Criteria:
  Big enough and sturdy enough to hold the food
  Weather proof
  Safe for the birds e.g. squirrel proof
  Constraints: Inexpensive to make and made form the materials provided

- **IMAGINE:** Research how other people have created bird feeders. What challenges did they encounter? What bird feeders already exist and what types of birds use the? Sketch some ideas.

- **PLAN:** Choose two to three of the best ideas and draw and annotate possible designs, ultimately choosing a single design to prototype.

- **CREATE:** Build the prototype, which aligns with design requirements and that is within the design constraints.

- **TEST:** Evaluate the design by testing and collect and analyse data; summarise strengths and weaknesses of the design that were revealed during testing.

- **IMPROVE:** Based on the results of the tests, make improvements to the design. Identify changes to make and justify the revisions.

NB: THIS PROCESS IS A CYCLE – NOT LINEAR

Materials: recyclables, string, sticks etc

Once the bird feeders are made, put them up in the school grounds and do some bird watching https://www.bbc.co.uk/bitesize/articles/zpdcydm

Once a few birds have been recorded, discuss the information recorded and ask some questions about it. For example:

How many birds of a particular type did you record on e.g. each day (or each hour etc.)?

Did you see the same type of birds at specific times of the day?

How many different types of birds did you see each day (or each hour)? etc.

Birds are important to nature's biodiversity and are indicator species: when the environment isn't healthy, birds let us know often because they disappear because they need a healthy environment to survive. Birds aren't the only indicator, but as they are found almost everywhere in the world their presence or absence is a good indicator for the environment.

Ask the children if they have suggestions for changes that could be made to the school grounds to attract more birds and/or different species of birds? (e.g. *planting, adding a bird bath/water, add nesting boxes etc.)*

Putting up the bird feeders could be done to coincide with taking part in the Big Schools' Birdwatch: Big Schools' Birdwatch (rspb.org.uk)

This activity also provides an opportunity for data handling.

Links to Es and Os and relevant benchmarks:

I can extend and enhance my design skills to solve problems and can construct models **TCH 2-09a**

- Uses tools and equipment in order to carry out a task safely.
- Estimates and then measures accurately using appropriate units and tools.
- Creates a range of ideas and chooses a suitable solution
- Evaluates solutions and explains why they are or are not suitable

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. **TCH 2-11a**

- Sketches geometric shapes to create objects.
- Sketches 2D and 3D drawings of objects

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

- Builds/simulates solutions to engineering problems.

I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way. **MNU 2-20b**

- Collects, organises and displays data accurately in a variety of ways including through the use of digital technologies, for example, creating surveys, tables, bar graphs, line graphs, frequency tables, simple pie charts and spreadsheets
- Analyses, interprets and draws conclusions from a variety of data.

I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs, making effective use of technology. **MTH 2-21a / MTH 3-21a**

- Displays data appropriately making effective use of technology and chooses a suitable scale when creating graphs.

Activity 3: Lichen Hunt

Background information:

The variety of species living in an ecosystem *(a community of living things and their environment*) depends on the other living things and on the environment that it lives in. The environment means the surroundings; that could mean temperature, air quality, rainfall or the amount of sunlight. If an ecosystem's environment changes then the range of living things that can exist in that ecosystem changes too.

Pollution changes the air quality and is one way that the environment can change.

Lichen is an unusual living thing - it is actually two things living together: a fungus (a bit like a mushroom) and an algae (a simple type of plant). Together they form their own type of ecosystem and different lichens can grow in different levels of clean air.

What's a lichen? | Rise 360 (articulate.com)

Lichen: Two Living Things In One | Biology for Kids (youtube.com)

Looking for lichen is a good way to find out what the air pollution levels are like in your local environment. You may find lichens on window sills, on the bark or branches of trees (both living and dead), on old walls, on old grave stones, or on old schools buildings.

Lichens are all around us! | Rise 360 (articulate.com)

There are two types of lichen that really give you a good clue about the air quality:

Green globular lichen called Hypogymnia which will only grow in clean places away from pollution e.g. woodland.

Yellow Xanthoria: If you live in a city or town or by a road you might find this. This lichen has adapted to growing where the air is polluted and will only grow where there is lots of pollution in the air.

Survey the local area and record where these 2 types of lichen are found: this could be done on a map, and/or by taking photographs? What does this tell you about the air quality in the area? This information could be made into a display.

Discuss what things are affecting the quality of air in your area – what could be done to improve it? *e.g. more people walking or cycling to school etc*.

Links to Es and Os and relevant benchmarks:

I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. **SCN 2-01a**

- Identifies characteristics of living things and their environment which have contributed to the survival or extinction of a species.
- Describes how some plants and animals have adapted to their environment, for example, for drought or by using flight.

Links to other SDGs

No poverty

Zero hunger

Good health and wellbeing

Responsible consumption and production

Climate action

Paz, justicia e instituciones sólidas ODS 16 Objetivos de desarrollo sostenible para niños (youtube.com)

Understand Goal 16: Peace and Justice (Primary) (youtube.com)

Conflict is something that we cannot seem to escape – sometimes because of a personal disagreement or we hear about wars that are taking place in the world. Peace and stability are essential for sustainable development.

Some areas of the world enjoy sustained periods of peace, but others experience what seems like never ending periods of conflict and violence. Violence and insecurity affect economic growth and can often result in long-standing grievances that can last for decades. Regions affected by conflict can also experience sexual violence, crime, exploitation and torture.

Compassion and a strong moral compass is crucial to every democratic society. Yet, persecution, injustice and abuse persist and are destroying the very fabric of civilisation.

Many of these issues also relate to human rights. If you are working towards a RRSA or exploring Children's Rights in the classroom there are numerous ways to explore SDG 16 and make connections with many of the other goals. (*UNICEF has lots of high quality (and mainly free) resources to help develop this: www.unicef.org.uk/rights-respecting-schools/resources)*

Activity 1: Follow the origami algorithm to creating a crane

Background information:

Cranes are recognised throughout the world as a symbol of peace. The connection between the two is based on the story of a young Japanese girl named Sadako Sasaki who lived in Hiroshima, Japan.

In 1945, an atomic bomb was dropped on the city which destroyed the surrounding region, killed thousands and had long-lasting consequences for those who survived. Sadako and her family survived the bomb, but by the age of 12, she had become ill with leukaemia due to the radiation to which she was exposed.

When she was sick, her father told her an ancient Japanese legend that if you folded 1000 origami paper cranes, you would be given a wish by the gods. Sadako quickly began folding as many cranes as possible to ask that her illness would go away. After she had folded 1000, her illness had not been cured but she didn't give up and continued to make more of the origami birds.

Sadly, she only managed to make 644 more before she died in 1955 aged 13. Her determination and courage were inspiring to others and the crane is now seen as a symbol of peace and hope.

Origami Instructions have a lot in common with computer programs. Algorithms are sequences of instructions that, to work, must be followed exactly and done in the right order. Computers follow programs and origamists (humans) follow origami instructions.

Origami can be used to highlight some important ***computational thinking skills.***

Computational thinking is the step that comes before programming. It's the process of breaking down a problem into simple steps; computers take instructions very literally and computers must be given instructions that are precise and detailed.

Origami is a very 'step-dependant' activity and precision and focus are needed to complete a task which makes it a really good 'unplugged' coding activity and perfect for talking about concepts like **Algorithms**, **Sequences**, and **Decomposition**.

- **Algorithms:** the sequence of steps needed to accomplish a task.
- **Sequence:** the order the instructions need to be done in to complete the task successfully**.**
- **Decomposition:** breaking a problem or task down into smaller parts to make it easier to tackle. This can sometimes involve working backwards from the end to the beginning.

Programming languages are standardised so that any computer can follow a program written by anyone in a given language. The notation used in origami is also standardised so that any origamist can follow the instructions from the sequence of diagrams written by anyone.

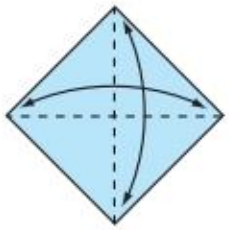
By following instructions exactly, you are behaving like a computer does – being what computer scientists call a "computational agent" – getting something done by following a set of instructions preciously even if you don't know what you are doing or why. Follow a set of origami instructions exactly and you will end up with an origami model.

Can you follow this sequence of steps precisely and make this origami crane:

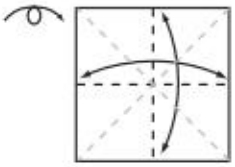
How to Make a Paper Crane : 16 Steps (with Pictures) - Instructables

or see next page

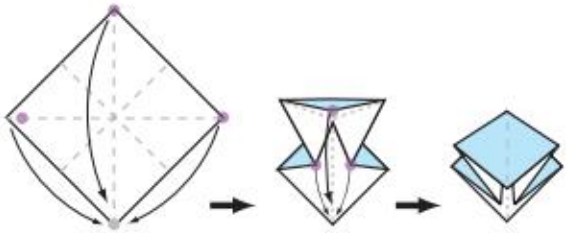
Peace Crane Instructions



1. Start with a square piece of paper, coloured side up.
Fold in half and open. Then fold in half the other way.



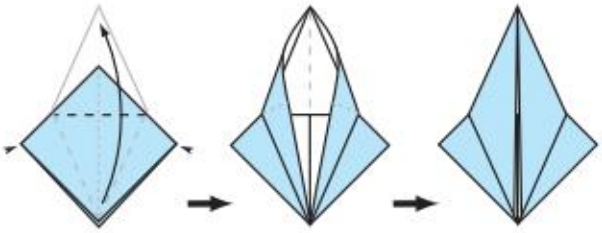
2. Turn the paper over to the white side.
Fold the paper in half, crease well and open, and then fold again in the other direction



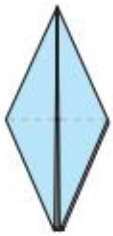
3. Using the creases you have made, Bring the top 3 corners of the model down to the bottom corner.
Flatten model

4. Fold top triangular flaps into the centre and unfold

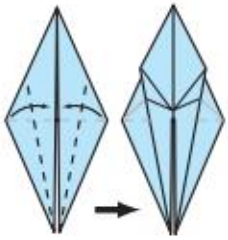
5. Fold top of model downwards, crease well and unfold



6. Open the uppermost flap of the model, bringing it upwards and pressing the sides of the model inwards at the same time.
Flatten down, creasing well.

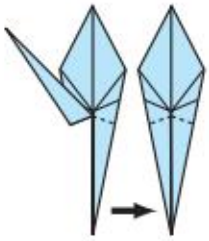


7. Turn model over and repeat Steps 4-6 on the other side.



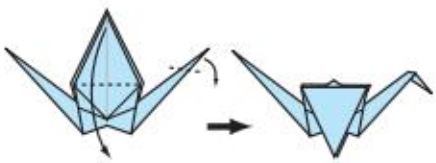
8. Fold top flaps into the centre.

9. Repeat on other side.



10. Fold both 'legs' of model up, crease very well, then unfold.

11. Inside Reverse Fold the "legs" along the creases you just made.



12. Inside Reverse Fold one side to make a head, then fold down the wings

Finished Crane

You could use the origami cranes to create a display or piece of art work that tells others about conflict and the importance of working for peace.

Activity 2: Create your own algorithm for an origami shape

Programming is about creating instructions that others can follow. Have a go at writing the instructions (algorithm) in English of how to make your favourite origami shape. Or invent you own origami shape and then write down the instructions using the picture notation. You are then doing a similar task to a programmer!

Links to Es and Os and relevant benchmarks:

I can create, develop and evaluate computing solutions in response to a design challenge

TCH 2-15a

- Identifies any mismatches between the task description and the programmed solution, and indicates how to fix them

Links to other SDGs

No poverty

Zero hunger

Partnerships to achieve goals 🤝 SDG 17 🌍 Sustainable Development Goals for Children (youtube.com)

The Sustainable Development Goals proposed by the United Nations need global partnerships for them to be achieved and cooperation between the partnerships - between governments, the private sector and civil society, to ensure a more prosperous future for everyone.

Partnership for the goals is about taking action and encouraging children and young people to find their voices as active global citizens. Useful organisations which can help with this include:

Fairtrade Foundation (Fairtrade Fortnight)

Send My Friend to school

The Great British Spring Clean

What is Global Citizenship? | Education resources | Oxfam GB

Activity: Connect with other classes and /or schools

Connect with other classes and/or schools and work in partnership to share ideas about possible STEM projects related to SDGs/global citizenship and plan for a collaboration!